

NATIONAL WETLAND CONDITION ASSESSEMNT (NWCA) FIELD OPERATIONS MANUAL (FOM) TECHNICAL REVIEW PANEL RECOMMENDATIONS

May 28, 2010

FOM TECHNICAL REVIEW PANEL

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OBJECTIVE

The objective of the Technical Review Panel (TRP) was to provide review of the NWCA 2010 draft FOM for Level 3 sampling over the course of a three day technical workshop. During the workshop, the TRP was charged with evaluating the latest revisions made to the FOM resulting from the 2009 piloting effort and 1) identify protocols ready for implementation and 2) identify protocols needing changes and provide recommendations.

BACKGROUND

The workshop was held at the EPA Western Ecology Division in Corvallis, OR, from May 18–20, 2010. The basic format consisted of the FOM development team providing lecture and field demonstrations of protocols from each FOM chapter, which the TRP could then evaluate and discuss. On May 18, the TRP discussed basic information about the data forms and data management as well as FOM Chapter 3: Establishing the Assessment Area (AA); on May 19, the TRP discussed FOM Chapter 5: Vegetation; and on May 20, the TRP discussed Chapter 4: Characterizing the Buffer, Chapter 6: Soils, Chapter 7: Hydrology, Chapter 8: Water Quality, and Chapter 10: Algae. In addition to the sessions, a brief presentation of a parallel project on ecosystem services and stable isotope analysis was given on May 19. During the afternoon sessions on May 19-20, the TRP was given the opportunity to meet separately from the FOM development team to discuss issues identified during the course the demonstrations and to formulate recommendations. This report is summary of those discussions. Recommendations and comments are organized in an overall section that includes higher level issues and then by FOM chapters.

OVERALL ASSESSMENT

The TRP agrees that the FOM/Level 3 sampling in its current overall form is generally suitable to meet stated NWCA goals. Few broad conceptual or fundamental issues arose. The TRP was generally able to work through these. The majority of the recommendations and comments will deal with more specific details of wording and protocols that require refinement. In many cases, the FOM development team presented these issues as such and was requesting input. Overall, the TRP is not recommending major structural revisions to the FOM/Level 3 sampling.

Larger issues that emerged during the workshop which span any specific section are listed below:

- ***Time required to execute field protocols:*** Throughout the development of the FOM, time required to complete Level 3 sampling has been a fundamental issue. The goal is to conduct all sampling at a rate of 1 site/day. The intention of the FOM is for sampling at the average site to equal 9 hours of sampling time. The time issue emerged early in the workshop and was discussed throughout. The TRP developed the following table to evaluate time necessary to complete a site. Time is given in hours and is expressed in terms of what the TRP estimated were reasonable minimum and maximum times for a work component given the collective experiences of the group. This allowed us to look at not just the average time but best and worst case scenarios.

TRP estimated time table (hours) to complete a single site.

Assumptions

- RAM will be completed with both members of the AB team working together
- Activities demarked by a subscript 1 indicate where AB team members can work independently. AB person #1 can do the buffer and AB person #2 can work the other components at the same time
- The AA establishment time was added to the total AB team time.
- Site totals summed by the limiting figure (e.g., max of either veg or AB whichever is higher) for each team and does not try to figure how one team would help the other when they have completed work

Team	Work Activity	Min	Max
AB	RAM	0.75	2
	Soils	2	5
	Buffer ¹	1	2.5
	Hydrology ¹	0.25	0.5
	Algae ¹	0.5	1
	WQ ¹	0	0.5
Veg	AA setup	0.5	1.5
	Veg plot setup	0.5	1
	Veg data	1.25	8

Total time range in the field

	Min	Max
AB Team	4.25	11
Veg Team	2.25	10.5

	Min	Max
Sample processing time (at truck/hotel/camp)	1	2

Total site time range (using limiting factors at each end)

Min	Max
5.25	13

1. The TRP agreed that the above time estimates were reasonable (including the assumed 9 hours/site average) and thus the overall workload in the FOM is on target.

2. The above analysis does not include drive, walking, sample processing, decontamination, and gear assembly/maintenance times. These will add time to the overall site rate but cannot be anticipated in a systematic way. Each site and regional context will be different (e.g., distance to FEDEX dropoff, availability of dry ice, etc). Addition of these factors may cause the overall work rate to drop to say 2 sites/3 days for a crew. This true overall site rate should be disclosed in the FOM.
 3. Remote sites that will take significant time to get to will require more than a single day and may take many. No strict rules were established on how long is too long to drop a site. It was suggested that if a water quality sample is needed getting into and out of remote sites in 3 days is necessary because of 24 hour holding times. A 3 day limit was used in previous national surveys. These sites will be in the minority and will have to be evaluated on a case by case basis.
- **RAM Sampling:** There was much concern over how the RAM sampling was going to interact with the level 3 sampling. There are many unknowns due to the current status of the RAM. Our understanding was that the RAM development team is suggesting that the RAM be done independently and before the Level 3 sampling due to the potential for bias. The TRP reacted to this by breaking into two camps:
 1. Walking the entire AA twice is repetitive and unnecessary. The RAM can be simply filled out at the end of the Level 3 sampling.
 2. An independent RAM sample is necessary because it needs to be done as if you'd be doing it on its own. The Level 3 information will bias the results and the RAM team will not be able to accurately evaluate the efficacy of the RAM.
 Ultimately, this is an emerging issue in the overall NWCA and is beyond the scope of this review. The following points were raised during the discussion:
 - NWCA/RAM objectives need to be reviewed and clarified. If it is a clear objective to test/validate/calibrate the RAM in the NWCA against the Level 3 data, then the bias concern would get more precedence. If the goal is to deploy the RAM as part of the national assessment, filling out the RAM at the end of the day would get precedence. Testing of the RAM would then be a different effort.
 - In general, walking through the AA/Buffer twice would promote field crew 'burnout'. Some sites will be too overtaxing to expect the AB team to do this. There is a likelihood that even if the decision were made to do independent samples, crews would not do it anyway given the Level 3 workload.

- ***How are the Data Going to be Used?:*** This question came up a number of times during the workshop where reviewers questioned the need to collect certain data or identified ambiguity in a measure. The TRP acknowledges that the FOM development team is working somewhat independently from the data analysis team and that the FOM is farther ahead. It was also acknowledged that it is impossible to know the entire population of analysis questions prior to going out into the field and thus impossible to know exactly the suite of data that should be collected in the field. Ultimately, it would be useful to refine the FOM/Level 3 sampling as much as possible as the data analysis team becomes more focused and to acknowledge in the FOM the needed balance between collecting data for defined purposes and those that may not have a specific purpose, but have potential analytical use.
- ***FOM - Site Evaluation Document/Other NWCA Documents Linkage:*** Coming into the workshop, the TRP did not necessarily have a clear understanding of the NWCA divisions of development labor which lead to some confusion. This specifically occurred when discussing the AA and how adjusting the AA in certain circumstances would interact with activities associated with the Site Evaluation Document (which hasn't yet been completed). When other NWCA documents become complete, clear linkages need to be made between them so that people know which document to turn to when needed. This should be done from the perspective of someone that has not been closely associated with the development of the NWCA. These divisions of development have arisen somewhat artificially under the need of trying to execute the entire project and may not be clear to an outsider.
- ***Elements that are Typically Measured at Greater than AA/Buffer Scale:*** There are a number of elements in the FOM/Level 3 sampling that typically occur or are observed at scales greater than the AA or 100 m buffer. The most common case is where an element occurs at the site/wetland or basin/hydrologic unit scale of which the AA and a portion (or all) of the buffer are merely a part of. The concern is that if these elements are only measured at the AA/buffer scale, it could lead to inaccuracies in indicator development and the assessment as whole. While the NWCA has to be constrained to systematic units and other sources of information (i.e., Level 1) will be able to provide information at larger scales, developers need to keep this issue in mind particularly when analyzing and extrapolating data. Known cases where this may be issue:
 - **Buffer/Stressors:** The actual stressors affecting the site (and hence the AA) may not be accurately captured at sites where the majority of the buffer falls within the contiguous wetland.
 - **HGM Classes (AA section):** HGM classes typically correspond with larger wetland hydrologic units. Are crews supposed to rely merely on what is observable at the AA or from information outside of AA? Would the HGM classification be more appropriately made from a combination of field observations and aerial photo/topo map interpretation?
 - **Water Sources Flux/AA Hydrology Stressors (Hydrology Section):** Water sources/fluxes and hydrology stressors occurring the hydrologic unit scale often will not fall within the AA. Do we bring in observation/interpretation from outside the AA when it's obvious? What if it isn't obvious? Do we need to determine water sources/stressors outside of the AA?

- Amount of Equipment:*** Initial concerns were raised on the overall amount of equipment necessary to complete the Level 3 sampling. These concerns subsided over the course of the demonstrations, particularly during the soils portion where it was explained how to target your particular soil equipment based on type information provided by the soil survey and the recon visit. It should be noted that at sites that require overnight wilderness camping, additional field crew members will be necessary to carry gear. In these situations it would be too much to expect a 4-person crew to haul all the sampling equipment (returning with soil, water, specimens, etc) and necessary camping gear (e.g., tents, food, water) into and out of a wilderness situation by themselves.
- Using GPS as the Primary Layout Measurement Tool:*** The AA, Vegetation, and Buffer chapters recommend using a laser range finder as the primary tool to layout various distances. The TRP disagrees and suggests that handheld GPS units should be the primary tool for laying out the AA boundary and buffer plots with measuring tapes being secondary. Once the center point is established, the GPS can be set to “Go To” the point which will give a bearing and range. These two pieces of information alone can guide the AB team to the buffer plots. At the field demonstration, a quick check revealed the handheld GPS returned a range within 0–3 m of the POINT, the southern AA boundary (40 m away), and the southern most buffer plot (140 m away) and a bearing within 2/3 degrees of the actual. The TRP feels that at the scale of the AA boundary and greater, error rates of 0–3 m/0–5 degrees is acceptable given the ease of use of the GPS. Within the AA (such as to establish veg plots), measuring tapes and compass may be more appropriate because of the smaller scale and that GPS bearings become unstable at close distances to the point. There will be occasions where heavy cover disrupt satellite signal and the GPS will be ineffective. In these situations, measuring tapes and compass will be necessary to establish AA boundary and buffer plots (there is an additional problem of finding the point in these situations). The range finder, in the majority of cases, won’t be effective due to line of site obstructions. For example, approximately 73% of freshwater vegetated wetlands are shrub or forested (Dahl 2006, Status and Trends...1998-2004), where the range finder will not be useful. Many of the emergent wetlands will also have obstructions that will partially render the range finder ineffective. When buffers exceed wetland boundaries, the likelihood of obstructions increase (as with the case in the demonstration). The TRP recommends that both the veg and AB teams each have a handheld GPS unit that at a minimum has the ability to give a bearing and range to a point. The model used during the demonstration was the Garmin GPSmap 76CSx <https://buy.garmin.com/shop/shop.do?plD=351#gpsmap76csx>.
- Realistic Trials & Work Sequencing:*** Following the final revision of the FOM and prior to training, realistic field trials need to be completed to make a final confirmation that the workload is on target and to more firmly establish the sequence of work. While a number of field trials were completed during 2009, the FOM has changed significantly. Also, it is unknown if these trials captured the true complexity that will be faced by NWCA field crews (e.g., were points targeted as opposed to random?; did the trials do all of the sample processing?; were trials performed over consecutive days?; etc.). Only field trials that incorporate accessing random points, where all the field components are executed and all samples are processed (even up to finding/driving to a FEDEX drop-off) and trials repeated over several consecutive days can accurately confirm the overall sample rate (i.e., sites/days).

Also, the overall work sequence was not entirely clear (at least during the demonstrations). One reviewer commented that we were instructed to do three separate activities first (RAM, AA, Water Quality). Figure 2-1 illustrates provides some clarity, though does not apparently include if/then rules specified in different places in the text. Refinement of if/then sampling rules and realistic trials will help improve the overall work sequencing.

SPECIFIC CHAPTER RECOMMENDATIONS

Chapter 3. Establishing the Assessment Area

General comments on the chapter

The TRP acknowledges that this is a difficult chapter where a number of rules are needed to establish the AA in the variety of scenarios that exist on the landscape. The majority of comments concern the AA Reference Card and how the rules established in the FOM are expressed in the card which will be the go to resource in the field.

Reference Card AA-1

- Reference card was confusing because the alternate layout names were the same as the AA layout key couplets, but couplet 2a did not get you to Alternate Layout 2a. Suggest changing the layout names to something descriptive OR x, y, z or some other designation totally different from the couplets OR use a flowchart instead of a dichotomous key.
- If layouts have descriptive names, suggestions are:
 - Circular standard (point at center)
 - Circular shifted (point not at center)
 - Rectangular standard (point on downstream edge)
 - Rectangular shifted (point not on downstream edge)
 - Freeform
- There should be a figure for Alternate Layout 1 because there are figures for everything else.
- The two figures for Alternate Layout 2a should be near each other and it should be clear *why* they are different.
- The text describing the rectangular AAs was confusing to many reviewers.
- Some reviewers did not like that the point should be on one edge for a rectangular AA, when it is in the center of circular AAs. Because the goal is to document the area around the point, using the point as the edge in some cases and the center in others makes for divergent protocols. This is particularly true for rectangular AAs, which can get up to 200 m long. In long AAs, the center of the AA could be 100 m away from the point, so all assessment will be shifted significantly away from the original point.
- Any diagrams that include a direction of flow should be pointing downstream and not upstream, as this is more common.

- Site evaluation guidelines need to be integrated into decision about AA establishment (see FOM – Site Evaluation Document Linkage bullet).
- There should be explicit instruction on the reference card to read the FOM when confused. People often forget that keys/guides typically simplify information for ease of use, but the full baseline information comes from a larger narrative explanation.

AA Field Forms

- There is nowhere on the forms to document waypoints for the AA other than the center. Do you want dimensions of AAs if they are other than the 40-m radius circle? Should crews note the size and shape or the bearings of rectangular AAs?
- The TRP did not like the diagrams of interspersed on the back of form AA-2. It is unclear what the white space represents and many people found this to be an incomplete representation of all possible arrangements. Also, what are the elements representing? Communities? Different species? Field crews will not be able to return consistent data without greater definition. There was also great concern that this is identical to USA-RAM and should not be recorded twice.
- Interpreting HGM classes (see Elements that are Typically Measured at Greater Than AA/Buffer Scale bullet).

Section 3.2.2 Alternate AA Layouts

The TRP had a number of questions with the alternative AA layouts, much of which is described above with the comments on Reference Card AA-1. Others include the following:

- One reviewer who had field tested the method in 2009 described great difficulty in establishing rectangular AAs. There were cases at narrow sites where it was determined that the wetland area > 0.5 ha, but it was too time consuming to establish a rectangular AA with straight sides because of the bends that were necessary. In these cases, the boundary of the wetland area was designated as the AA boundary (making the edges wavy instead of straight segments) and the ends were based on 0.5 ha overall size, as calculated from walking the perimeter with the GPS unit. In the protocols, freeform boundaries are only used with wetlands < 0.5 ha. How important are the straight segments within narrow, bending wetlands that are > 0.5 ha?
- Within rectangular AAs, veg plots and buffer plots can have separate axes radiating from the center when the AA is not oriented on cardinal directions (i.e., buffer plots along cardinal axes and veg plots along AA axes). Many reviewers were uncomfortable with this, thinking that it has the potential to cause much confusion in the field. One reviewer suggested that for rectangular AA layouts, both the veg plot (when width > 30 m) and buffer axis be oriented according to the midpoint of the AA sides. That would make one set of axis in these situations; however, it would mean a deviation from cardinal directions for the buffer plots.
- There may be cases where the wetland area and the AA/buffer will extend beyond the boundary of the sample frame (FWS S&T plot). The development team stated that this is ok. There should be some guidance on this in the FOM.

Chapter 4. Characterizing the Buffer

General comments on the chapter

This section of the FOM is pretty straightforward. Overall, there needs to be guidance on how to handle partial accessibility for the set of buffer plots (i.e., what to do when you are not allowed or physically cannot access some of the buffer plots when you already have access to the AA). The extension of the buffer plots in some situations can lead towards complex landowner permission situations. When would a site be rejected as “no access” in these situations? The only other major comment was that many reviewers suggested that all data for each buffer plot be on one page, eliminating the need to flip pages at each plot. This was discussed in detail with the chapter author.

Section 4.1.2.2 Buffer Natural Cover Strata (Form B-1)

- Leaf litter should be a separate category on the data form.
- The bedrock category should be changed to just rock. There are situations where open rock exists, but that rock is more from glacial origins as opposed to part of the bedrock.

Section 4.1.2.3 Buffer Stressors (Form B-2)

- For the stressor checklist it is unclear what the tally and total columns are for. It would be virtually impossible for any of the stressors listed (in current form) to occur more than once in a 10m x 10m plot. Thus, the individual buffer plot bubbles are all that are necessary to record in the field. Totals can be summed from the database.

Chapter 5. Vegetation

General comments on the chapter

Overall, the TRP felt the vegetation protocols have significantly improved since the first draft of the manual. Two important changes have been made to the protocols: 1) the vegetation plots are now systematically placed within the AA in a standardized fashion (to the extent possible) and 2) full species lists are recorded for only five plots. Both changes significantly shortened the amount of time necessary for carrying out the vegetation sampling and achieve a more repeatable and standardized method. The TRP felt both changes were positive and had no major concern about the overall state of the protocols. All comments were directed at smaller details of the protocols that need clarification or improvement.

Section 5.1.1 Vegetation Plot Layout

In general, the TRP felt that guidance on vegetation plot layout was clear, but could be improved with a few suggestions. We preface this section by saying that few reviewers had read the manual carefully before commenting. Most were reacting to the field exercise, forms, and reference cards without the accompanying written explanations. It may be that some of the issues raised would not be problematic if we had read the manual thoroughly before applying it in the field. There are a few cases where something we struggled over was actually written out clearly in the manual. We have removed questions that are obviously issues with us not reading the text thoroughly, but have kept other suggestions that might still improve clarity.

- **Reference Card V-1:** The key to vegetation plot layout given on the reference card should be repeated in the manual text. In general, the TRP felt that anything on a reference card should be given in more detail within the text. Even though the plot layout descriptions are within the text, a key or decision tree should also be spelled out. We realize this may seem redundant to the manual authors who are extremely familiar with the concepts, but we thought it needed to hit you over the head. In the text, the key could indicate the sections where the alternate layouts are described.
- The key to vegetation plot layout (like the key to AA layout) posed some difficulty for TRP members. In both cases, it was confusing that the couplet numbers in the key were similar to the alternate layout names and that the alternate layout names were not descriptive. This was not as confusing in the veg plot layout key as in the AA layout key because the alternate veg plot layouts are named 1, 2, 3 and not 2a and 2b (exactly like the couplet names), but the panel felt that short descriptive names would help clarify the key. For instance,
 - Standard Veg Plot Layout = Circular AA, Veg Plots on Two Axes
 - Alternate Veg Plot Layout 1 = Wide Rectangular AA, Veg Plots on Two Axes
 - Alternate Veg Plot Layout 2 = Narrow Rectangular AA, Veg Plots on One Axis
 - Alternate Veg Plot Layout 3 = Freeform AA, Veg Plots Distributed

This is very similar to what is already written in the boxes on the reference card, but reviewers were still confused. It was not apparent from the key on the card that the difference between alternate layout 1 and 2 is that the plots are on two or one axis depending on the width of the AA.

- The diagram for Obstacle Veg Plot Layout should be changed so that the obstacle represent < 10% of the AA.
- **Section 5.1.1.3: Alternate Veg Plot Layout 1.** On the reference card, there are two different versions of alternate layout 1, but the difference is not explained. A brief phrase in the box for alternate layout 1 on the reference card that says, “AAs with width < 40 m, only use one side of the short axis” could help clarify. Or this could be added as another couplet in the key. We also felt the width break should be identified. At what point is the AA too narrow to use both sides of the short axis? 40 x 125 m? 50 x 100 m? Guidance is advised.
- **Section 5.1.1.4: Alternate Veg Plot Layout 2.** Same comment as above, there are two different versions of alternate layout 2. Maybe a brief phrase in the box for alternate layout 2 would read, “AAs with width < 30 m, center plots on placement line.” Or an additional couplet for this layout should be added to the key.
- **Section 5.1.1.3 & 4: Alternate Veg Plot Layout 1 & 2.** The TRP was somewhat concerned that when the veg plots are laid out on the long and short axis of the AA and the buffer lines radiate out to the cardinal directions, this creates two sets of lines. This might be OK when actually tried in the field, but some people were concerned that this might be confusing. Suggestion is to try piloting this layout in rectangular AAs. (See similar comment in the Buffer chapter.)
- **Section 5.1.1.5: Alternate Veg Plot Layout 3.** Specify that each plot should be oriented on the cardinal directions where possible, but can be individually oriented to the most efficient placement when orienting to the cardinals does not fit.

- As we are advising in the AA establishment sections, crews may need the flexibility to do Alternate Veg Plot Layout 3 for wetlands that have complex edges, but may be ≥ 0.5 ha. As the protocols are currently written, you can only move to a freeform AA and subsequent Veg Plot Layout if the AA is < 0.5 ha. There are some wetlands ≥ 0.5 ha where rectangular AAs are difficult to layout because the edges meander and make many turns.
- **Section 5.1.1.6: Obstacle Veg Plot Layout.** As written, the obstacle layout only applies to standard AAs. It might be that this is also applied to rectangular or freeform AAs. This choice should not be mutually exclusive with the others. Perhaps it should be an additional set of bubbles for all sites to mark Y or N if obstacles were present that forced the AAs to be moved.

Section 5.1.2 Establishing the Vegetation Plots

Overall, this section was very clear and easy to follow. Only a few comments.

- The distance from the center and the first plot should be specified for the standard plot layout as are the relative distances as all the other plots. A distance of 2 m was suggested.
- Veg plot layout should be done with tape measure and compass, as handheld GPS error within the AA scale may cause unwanted plot placement.
- **Form V-1:** Where the form says “Plot Placement Bearings,” an additional choice should be added and some of the description should be removed because it is repetitive of the section above that asks about the overall layout of the veg plots. The three choices would then be:
 - Cardinal Directions (no description given, since knowing they are on cardinals is all that’s important here)
 - Along Axes of Rectangular AA (followed by a place to record the two bearings that apply to all plots)
 - Individual Bearings by Plot (must mark bearings next to each plot coordinates)

Alternatively, crews could always write down the bearings for each plot. If they are cardinals, crews will write 0 or 360 for each plot. If the AA is a rectangle, they write the same bearing for each. If they are all different, they write something different for each.

Section 5.1.3 Vegetation Data Collection

This section was also clear on the whole. However, as this is the heart of data collection, there were numerous small suggestions from the TRP.

- **Form V-2:** The title of this form should be changed to NWCA Vascular Plant Species Presence and Cover to clarify that no non-vascular species are included.
- In the instructions on the header, there is no #6 in the list.
- The way in which the nested corners are recorded on the form needs to be modified to include a choice for presence in the 100 m² area either within one nest or on its own. And there needs to be a choice for “Absent” in each nest. For every species on the list, it needs to be clear whether or not it showed up in the nests or whether it was added from the 100 m² area. Right now, additional species are recorded from the 100 m² area with no specific designation, but it will be impossible to know whether they are from the 100 m² area or whether the recorder forgot to fill in a nest bubble.

- There was a suggestion that the strata column be moved between the nest columns and the cover column, because it might be best to determine strata/height at the same time as estimating cover, as it applies to the species height across the whole plot and not where you first find it.
- Some reviewers like the workspace idea of summing cover for all four quarters. Others thought that averaging the four quarters would be better. This seems like a personal preference, but should be strongly emphasized in training if it is important to do it one way or another.
- Reviewers were wondering if “K” flags would be necessary for all lines on a page that do not contain a species name, specifically all the lines that follow the last recorded species. Same question applies for all lines on the backside of a page, if only the front includes species.
- **Section 5.1.3.2: Collecting species presence data / Form V-2.** It definitely needs to be spelled out that after both corner nests are searched, the entire 100 m² area is walked to identify any additional species in the plot. This is done as a separate task before estimating cover. This should also be on **Reference Card V-2**.
- The manual mentions that species are included in each unit if they are rooted in or overhang the plot. It might be good to add a sentence that says: “Make sure to look up when working in the nested corners, as species overhanging the plot may be above your head.” Many reviewers would not have done this instinctively.
- **Section 5.1.3.4: Vascular plant species data / Form V-2.** This section seems a little out of place. Some of it is repetitive and covers information in the two preceding sections (5.1.3.2 and 5.1.3.3), but also introduced new ideas like the vertical strata. We would advise breaking this apart and moving the information related to strata and identifying entities (like the differentiation between strata for trees but not shrubs) to Sections 5.1.3.2 and the information related to cover estimates to 5.1.3.3.
- Because this is the first place that strata are introduced, we will use this section to provide feedback on the **vertical strata**. This issue occupied the most discussion time of any single question in the veg protocols. Several people were very uncomfortable with the vertical strata as written because they are a hybrid of lifeform and vertical strata. There were divergent opinions on how this should be fixed, so we leave the final resolution up to the authors, but would like to highlight a few different potential changes.
 - Many reviewers felt that mixing life form and height classes was confusing and would prefer to see this turned into a pure height class designation for all species except lianas and aquatics. This would provide a more universal solution to a number of scenarios that were brought up during the discussion. Because most species occupy only one lifeform, the strata designation is redundant in many cases. For example, *Carex utriculata* can only occupy the ground stratum. The lifeform can be deduced by querying the species list against information within ITIS or USDA PLANTS. Moving to a pure height class scale would give you one specific type of data within that column. It would also provide more structural information on herbaceous species that can vary by height, such as very tall invasive graminoid species. The height classes recommended include:
 - > 10 m

- 5–10 m
- 2–5 m
- 0.5–2 m
- < 0.5 m
- Submerged aquatic
- Floating aquatic
- Lianas and epiphytes
- It was recommended that the authors look through the height classes used in the Rivers and Streams protocols. To the extent possible, it would be good to standardize across the different national surveys.
- Some reviewers felt it was confusing to record tree species in numerous different strata while all other species groups were only recorded once. It was understood that this is to obtain some indication of regeneration within the cover data, but there was concern that collecting the data in this way is mixing two objectives and data types. These reviewers felt the cover data by species should only include each species once and that regeneration and age class structure should be recorded by other means. For one reason, multiple estimates of cover for one species may need to be combined in the data analysis to create total cover for that species. Because there can be overlap of strata, this is not straightforward addition. If this suggestion is taken, there are two different ways it could be addressed:
 - Regeneration could be accounted for with the stem counts by DBH. If so, there needs to be an additional small stem (< 5 cm) category added to Form V-4 to account for the smallest seedlings and saplings. This category could be an estimate of cover instead of a stem count to avoid difficulty in plots where small diameter stems are numerous.
 - There could be an additional table somewhere on Form V-3 or V-4 that specifically breaks down cover for every tree species by height class in the same way we currently do it on form V-2.
- In general, as with many of the trickiest sections in the manual, the TRP encouraged the authors to think seriously about how the data might be used and analyzed when deciding how it will best be collected. If total cover by species is needed, cover should not be broken up by strata. If some index of regeneration is needed, will stem counts by DBH or cover by height class be a better measure? Perhaps we need to collect the data both ways in 2011 to better understand which method is more effective.
- Regardless of how the strata are handled, reviewers also agreed that they should all have two-letter codes. Having a few with one-letter codes is confusing. Mid-canopy trees should be MT, tall shrubs should be TS, and ground should be GR.
- One change that everyone agreed on was that the height classes listed here should match the buffer categories.
 - On the buffer form, trees are divided between big and small based on 0.3 m BDH. On the veg form, there is a subjective criterion of canopy and mid-canopy.

- On the buffer form, it is implied that all trees are > 5 m, otherwise they would be included with woody shrubs and saplings 0.5–5 m tall (this should be spelled out clearer if this isn't the case). On the veg form, trees start at > 4 m. This should be changed to 5 m to be parallel with the buffer category, unless there is a strong reason why both should be 4 m. Either way, they should be the same.
 - On the buffer form, there is a separate category for shrubs < 0.5 m, but on the veg form, they are lumped with ground. Conversely, on the veg form, there is a category for low shrubs 0.5–2 m, but low and tall shrubs are combined on the buffer form. It seems fine to be more fine scale on the veg form than the buffer form, but if that is the case, then very low shrubs (< 0.5 m) should be called out separately on the veg form like they are on the buffer form or they should be combined with the herbaceous ground layer on the buffer form.
- On the veg form, it does not actually say that the canopy stratum is > 4 m (or 5 if changed). If the mid-canopy and canopy designations are kept, it does need to be specified that they are both > 4 (5) m. This should not be left up to individuals to decide whether a tree should go in tall shrub or canopy. Reviewers did not like that much subjectivity on the form, even if the canopy is low. This would also be alleviated if height classes are used instead of lifeforms.
- Somewhere in the text or on the form, it should be noted which category trees fall into if they are scattered individuals that do not form a canopy, but are > 4 (5) m. Is this canopy or mid-canopy? If height classes are used, this would not be an issue.
- Reviewers wanted more clarification on the term lianas. Does this include all woody vines? What about herbaceous vines? The term lianas is used more in certain regions of the country and not universally familiar.
- **Section 5.1.3.5: Vegetation strata cover data / Form V-3.** Many of the comments from above apply here, but were first raised on Form V-2. This section needs to be consistent with whatever is done on the Form V-2. The only other major change would be to take bryophytes and lichens out of this liana and epiphyte stratum and make a separate line for it in the % cover non-vascular section. Also, make sure field crews know that a 0 must be filled in for strata with no cover.
- **Section 5.1.3.6: Non-vascular taxonomic groups / Form V-3.** These categories should say:
 - Cover of bryophytes (mosses and liverworts) growing on ground surfaces, logs, rocks, etc.
 - Cover of lichens growing on ground surfaces, logs, rocks, etc.
 - Cover of epiphytic bryophytes and lichens
 - Cover of filamentous algae.....

Each of the phrases should start with Cover of... or some other phrase to be consistent (Percent cover of...). The same applies for ground surface attributes.
- Guidance should be given for how to estimate cover of epiphytes. Is that also strict aerial cover? Is it relative surface area? What is the convention?

- Any place there is a Y/N questions, there should be two bubbles, one for yes and one for no. It is important to know the difference between no and no answer. Reviewers also suggested that the background behind the bubbles be grayed out so the bubbles really jump out.
- Under macroalgae, where it says % cover of wrack, it should specify that the estimate is just for the algae that occurs as wrack, not all wrack.
- Also for macroalgae, it should be clear if this includes both surface and benthic algae.
- **Section 5.1.3.7: Ground surface attribute data / Form V-3.** For % cover water, the TRP thought it would be best to estimate total % cover water, including vegetated and open water at all depths, first before breaking it down further. Indented beneath that estimate could be the estimate of 1) open water, 2) water with emergents, and 3) water with floating and submerged veg. These three sub-estimates should add up to the total cover of water or could add up to 100%. If this suggestion is followed, it will be important to specify if the indented percentages are of the total plot area or of the total water area (a percent of a percent). It should also be clear if one vegetation type trumps, likely the type with more dominant cover, since you can have both emergents and floating veg in the same area.
- Because there are water measurements involved, there should be a timestamp on the form for each plot's estimate, as waters may be rising or falling during the course of sampling.
- Water depth measurements were problematic to many on the TRP. There is not enough guidance given for how to select the three measurements currently included. A few different options were discussed, but like the strata discussion, no concrete solution was agreed upon. Like the strata discussion, it seemed important to determine how the data might be used in order to decide which approach is best. Two options are given below:
 - The three measurements could be specified to be the max, min, and predominant depths.
 - Total cover water in the plot could be broken down into water depth categories in the same manner as the open/emergent/floating veg. Percent cover could be estimated for the depth categories such as < 10 cm, 10–50 cm, and 50–100 cm. It is assumed that the veg plots themselves will not be laid out with > 1 m water.
- For litter type, the line should either say predominant litter type or fill in all that apply.
- For litter depth, make sure it's clear whether by corner you mean at the very corner point or in the middle of the 1 m² corner plot.
- For cover of coarse and fine woody debris, most reviewers thought that standing snags and standing dead shrubs should not be included in woody debris. Many have used the 45 degree rule for determining if something is a snag or woody debris; if the angle of the dead tree is > 45 degrees from the ground, it is a snag; if it is < 45 degrees, it is coarse woody debris. Since snags are being measured on form V-4, it might not be important to estimate their cover, but if a cover is needed, a separate line could be included for cover of standing dead trees and one for standing dead shrubs. To clarify, the woody debris categories could be re-titled downed coarse woody debris (> 5 cm diameter), downed fine woody debris (< 5 cm diameter), standing snags (> 5 cm diameter), standing dead shrubs and trees (< 5 cm diameter).

- **Section 5.1.3.8: Shrub heights, tree and snag counts / Form V-4.** On the header of this form, there is a place to put the state, but this was not on any other veg form. It seems like something that should be only on the initial AA establishment form. Header formats should be standardized across all forms.
- The shrub height estimates seem redundant with the strata designations on Form V-2. These data may be slightly finer scale, but the strata designation gives a range (<0.5 m, 0.5–2 m, 2–5 m) from which you could use the midpoint and get a similar result. If anything on the veg form should be trimmed, this is an obvious place to cut. But it might not take that much additional time.
- If the shrub heights stay in, it should be clarified if trees < 5 cm DBH or < 4 or 5 m height are included in the shrub height estimates. Small trees (< 4 or 5 m) were included in shrub categories on Form V-2, so one might also assume they are counted as shrubs here.
- The snag and live tree count table needs headers above the white and gray boxes to clarify what each is used for (workspace and count). It is written in the text on the form, but headers would help.
- Clarify in manual and on form if 0 should be filled in for all size classes absent from a plot. If a certain tree species only occurs in one DBH size class, should it get 0 for all others so that the line is completely filled out?
- Certain reviewers have used a cut out DBH caliper card in the field. Look for easy to use DBH tools to aid teams.

Section 5.1.4 Field Day Wrap-Up

- If a species marked on a form for collection is later IDed in the plot, is it OK to erase the collection mark?
- What should the field crew do if they collected a plant, pressed and dried it, but then figured out what it was before sending it on to the lab? Can the field crew change the name on the data sheet or on Form V-5? There isn't any space for the crew to transmit species IDs after the day of sampling.
- The panel would advise that plant pressing occur at the vehicle when/where feasible, but that in some case, pressing at the field housing may be preferable. If plants are very dirty and have large clumps of soil attached to the roots, it is very difficult to make a good pressing. It can be very helpful to wash the roots of certain plants before pressing, which may need to be done at the field housing. Also, working in the wind presents obvious challenges to newsprint, blotter paper, etc.
- It is strongly emphasized in the FOM that plants must be pressed the day of collection, but there will be cases where this is not possible without keeping the crew up until midnight. It is OK to acknowledge that this is the case and to say that if pressing has to occur the following day, make sure that specimens are kept in a cooler on ice or in a refrigerator until pressing.

Section 5.2 Sample Collection and Processing

This section will be incredibly helpful to crews. It is thorough and well explained. Thanks for including it. We had just a few comments.

- Many reviews felt that placing one specimen per bag would not be realistic if you have numerous specimens from one site. It might be helpful to state that if numerous specimens are collected, more than one can be placed in a bag *if* they are distinct enough that they will not be mistaken and *if* the tag is somehow attached to the specimen.
- Some reviewers also suggested adding to the manual that photos can be taken of unknown plant species to aid in species identification. This would be optional, and the team would need to track the photos in their own way, but might be good to add to the manual as optional guidance.
- **Section 5.2.3: Plant specimen label.** Because there is more data on the plant label than will be recorded on the V-2 form, it would be good to advise crews to keep a field notebook or other tracking system to write notes about collected species in order to fill out the labels thoroughly.

Chapter 6. Soils

The TRP is deferring substantial comments on this section to the NRCS soil experts: Pill King and Lenore Vasilas. Their comments should address the following:

- Recommended level of expertise required to execute the protocol, including minimum expertise/training recommendations.
- Working with NRCS for local assistance.
- Guidelines for Site Evaluation.
- Greater explanation of stressors. Are these only ones found in the soil profile or do they include active stressors occurring on the soil surface in the vicinity of the pits? What are some indicators of historical stressors in the soil profile? Are there important differences between anthropogenic stressors and natural disturbance (e.g., sediment layers in riparian soils) and are they interpretable?
- Required pit depth: one length of the sharpshooter or 60cm?
- Guidance for selecting the 'quantitative' pit where bulk and bulk density samples taken.

Chapter 7: Hydrology

General comments on the chapter

There is some concern that the Level 3 hydrology data is duplicating information in the USA-RAM and vice versa. This was a major theme throughout the protocols, but should be mentioned for this section in particular because it was brought up in discussion.

General comments on the form

- At the very top, the form asks about tidal stage. There needs to be a bubble for none for sites that are nontidal.
- There should be a timestamp on this form, as hydrology may change during the course of a day and it will be important to note when the form was filled out.

- The hydrology form does not include flag fields like other forms. This will need to be added and standardized like the other forms.

Section 7.1.2 Water Sources

This section is more than just sources; it is really “inputs and outputs” or “flux.” The heading for this section should be re-titled to reflect that. The TRP had the following specific comments.

- It should be emphasized in the manual and on the form that the inputs and outputs observed are only those within the AA. This should be written on the form at the top of each section.
- For each potential water source, the first question should be presence or absence, regardless of quantity or importance. There needs to be a place where it is clear that the teams evaluated each source and marked present or absent.
- The P/A marking could be integrated with the Top 3 rankings. There could be five circles, P, A, 1, 2, 3 and everything marked 1, 2, or 3 should also be marked P. Or it could be 1, 2, 3, 4, No and things marked as 4 would present, but not one of the top three sources.
- The manual should clarify how to rank water sources that are most influential, but do not occur in the AA. For example, if there is not a ditch in the AA itself, but it is clear that water in the AA came from a ditch right outside the AA. Should that water source be marked as absent within the AA, but given a 1, 2, or 3 for importance? How hard should crews look for and/or document water sources outside of the AA?
- Marking the quantity should only be an option for those water sources that can potentially be counted. The quantity area should be grayed out for sources that only occur as presence/absence.
- Sources should be grouped on the form in similar categories, all natural sources at the top and all anthropogenic sources below.
- An additional water source category should be added for tides themselves. TRP members from coastal areas noted that tidal channels are not the only tidal water source, nor would the term ocean be adequate to cover tidal waters in back bays. They recommended a category called tidal estuary under tidal channel.
- The outflows section of the form should be constructed parallel to the inflow section. All potential outflows should be listed and evaluated if they are P or A and the top three outflows should be evaluated. This should be done separate from the inflows. Right now, outflows are all combined and are listed as if they could be one of the top three most influential sources.

Section 7.1.3 Hydrology Stressors

- The hydrology stressors section should be formatted like the inflow and outflow sections, with a P, A, 1, 2, 3 (or other format). Anything that can be quantified can have a quantity space, but those that can’t be quantified should be grayed out.
- The ditch measurements should be after the stressor list. They are confusing when inserted in the middle. And they should not have the 1, 2, 3 bubbles.
- Culverts and pipes are artificial water inflows and outflows that are not listed in the stressors.
- Shallow channels should be removed, as this is supposed to be part of RV Tracks and/or Cattle Trampling (which is written Cattle Trampling without the “l”).

- If impervious surfaces should be noted as a stressor, it should be in the list and not relegated to other. Would you ever have impervious surfaces in the AA? Is this something that could be in the AA with < 10% cover? When else would you put this stressor?
- Same question as mentioned above applies to stressors that are obviously impacting the site, but do not occur in the AA. Would you rank them in the 1, 2, 3 count?
- Right now, fresh sediment influx is described in the stressors section of the manual, but is in a different area on the form. The flow of the manual needs to follow the flow of the form. Fresh sediment influx is not a stressor in all wetland types. There are many riverine and estuarine wetlands for which fresh sediment influx is a very important part of the sediment balance. It is fine to ask about fresh sediment, but it should be separate from the stressors section. And it should be emphasized that we are interested in any sediment, not just from anthropogenic source, as it is sometimes hard to distinguish the origins.

Section 7.1.4 Drift Lines

- Many reviewers agreed that this section should be expanded to include all indirect indicators of wetland hydrology listed by the Army Corps of Engineers in the Delineation Manual and Regional Supplement documents. Drift lines are not the only way to infer high water levels.
- The estimate of % cover surface water at the time of sampling and at seasonal or temporal high water should be moved to be part of the section determining wetland hydrology. The indicators of hydrology are noted in an effort to make this estimate, so the two need to be connected in the manual and on the form.
- Seasonal high water should be re-phrased to include the high water line of high tides, which are not seasonal highs. It should be made clear that this can be estimated even if the drift lines or other indicators are not in the plot. If it is clear that the entire AA is submerged during high tides, then the estimate is 100%. Right now, it seems more confusing than it is and people were unsure what to write.
- Does surface water have to be a given depth to count in this extent? In the water quality and algae chapters, a depth of 15 cm is mentioned as the minimum depth for sampling. Does that apply to this estimate? Or is any water, whether it is 40 cm or 0.5 cm apply here?

Section 7.1.5 Soil Pit Water Depth

- All reviewers felt this should be removed from the hydrology page and recorded as part for the soil data collection. Even though this is a measure of hydrology, the flow on the forms should be driven by what makes sense to the field team, not by data theme. The data base can pull this piece of information out from the soils form and store it with the hydrology data if needed.

Section 7.1.6 Annual Hydroperiod

- It seems unnecessary to include this section in the manual as it does not relate to any data being collected. We would advise removing it.

Section 7.1.7 Weather the Day Site is Visited

- Like a timestamp, this information is important to help put the hydrology in context. We recommend moving this to the top of the form along the timestamp and the tidal stage information. It might be good to have two brief lines, 1) weather on the day of sampling and 2) weather preceding sampling. It would be good to know if there had been torrential rains for three days before sampling.

Chapter 8: Water Quality

Section 8.1 Summary of Methods

- Some of the text in this section of the manual refers to pieces of data recorded on the hydrology form, such as tidal stage and water source (though it is not clear whether the reference to water source is the source of the water sample or the primary source for the AA). The text of Chapters 7 and 8 needs to be evaluated side by side to make sure that it is clear which data are collected in which protocols.
- On the form, surface water should be spelled out instead of using the acronym SW because there are many other places on other forms where SW refers specifically to southwest.
- QA procedures to re-sample one in every 10 samples should be pulled out into its own section with a header so that it does not get missed by the crew.
- As has been suggested in other chapters of the manual, the data collected across both the hydrology and water quality chapters should be determined based on the potential use of the data. What questions are we trying to answer with these data? How will the data be analyzed? What specific data points will be useful in analysis?

Section 8.2.3 Surface Water Protocol

There are really two separate activities included in this chapter, but both are merged into one section in the manual, which may be confusing to field crews. The two activities as they are written now are:

- Documenting characteristics of surface water:
 - Presence of water > 1m
 - Max depth of surface water
 - Characteristics of surface water
- Water quality sampling
 - Collection of a sample for lab analysis
 - Collection of *in situ* parameters of DO, pH, conductivity, temp

These two activities should be made two different subsections within the manual and the form needs to be reformatted to match the flow of data. It needs to be very clear whether the characteristics of surface water apply to the entire AA or if they apply to the specific area where the water sample is collected.

If the characteristics of surface water apply to all surface water in the AA and not just at the point of water quality sampling, then these questions are related to measures in the hydrology section and

perhaps some of the questions should be moved from one form to the other. There is a logical flow between the follow set of information:

- Indicators of hydrology observed in the AA. (Currently recorded in the Drift Lines section of the hydrology form, which should be expanded to include all indicators of hydrology.)
- Estimated maximum extent of surface water due to tides or seasonal high water. (Currently on the hydrology form and inferred from the indicators of hydrology or knowledge of the site.)
- Presence or absence of surface water in the AA at the time of sampling (greater than a certain depth? 0.5 cm? 2 cm? 5 cm? 15 cm?). (Y/N question that is currently not on any form, but should be added to one or the other.)
- Extent of surface water in the AA at the time of sampling. (Currently on the hydrology form, but not clear if a minimum depth applies.)
- Presence or absence of surface water > 1 m depth in the AA at the time of sampling. (Currently on the water quality form.)
- Extent of surface water > 1 m in the AA at the time of sampling. (Not currently on either form, but perhaps should be added.)
- Maximum depth of surface water in the AA at the time of sampling. (Currently on the water quality form.)
- Characteristics surface water at the time of sampling. (Currently on the water quality form.)

A few specific suggestions were made about the characteristics of surface water:

- Substrate should include clay as option.
- There should be a place to note whether the substrate is covered in vegetation or algae.
- Water smell should include more options, including anoxia and algal bloom.
- Some estimate of water clarity should be added.
- It was suggested that the authors review the National Lakes Survey protocol for the format of this section. Where ever possible, it would be good to take advantage of protocols that have already been applied in other national surveys, particularly for protocols that are standardized within a discipline. Water quality/characteristics such as this are likely more developed within limnology than wetland ecology, so we should borrow from their knowledge and experience.

Members of the TRP suggested two substantial changes to the water quality sample protocols.

- **Suggestion #1:** As currently written, water quality samples can only be collected if standing water occurs within the AA. It was suggested that the field team also be allowed to take water quality samples from the buffer if no standing water occurs in the AA, but does occur in the buffer. The reasoning behind was that the water chemistry sample has already been budgeted into every site and it would increase the chances of finding sampleable water, thus providing more data for a national analysis. How this affects the sample design and if speculative extrapolations of water quality from the buffer can be married with water quality data from the AA is unknown. The AB Team will be walking through the buffer potentially two times before water quality sampling: once for the USA-RAM and once for the Buffer protocols. If the AB Team identifies standing water in the buffer appropriate for sampling, they can return to the spot for

sampling. The AB Team should not spend additional time looking for water in the buffer if they did not find it during the previous walk through.

- If this suggestion is followed, there should be guidance on when buffer water is appropriate for sampling. The following guidance is suggested:
 - Water samples should always be taken from the AA when possible. Water samples should only be taken from the buffer if no appropriate water occurs in the AA.
 - Water samples may only be taken in the buffer if the standing water is part of the same contiguous wetland complex, though not necessarily the same S&T wetland class.
 - If multiple locations appropriate for water sampling occur within the buffer, the location closest to the AA perimeter should be chosen.
 - Water samples should not be taken from a river /stream or lake adjacent to the wetland, as they are a non-target population and will likely be different from that within the wetland.
 - Coastal experts should be consulted to ask if water samples could be collected straight from ocean or tidal water adjacent to the wetland.
 - The form should include a set of bubbles that indicate whether the water sample was collected in the AA, in the buffer, or not at all.
 - Wherever water samples are taken (AA or buffer), there should be a place to record Lat/Long coordinates of the water sample.
- **Suggestion #2:** As currently written, *in situ* measurements of DO, pH, conductivity, and temp are optional. Some on the TRP suggested that DO remain optional, but pH, conductivity, and temp be made a fixed component of the protocols. All three of these measures are standard water chemistry measures made in wetlands and have documented relationships to vegetation. Though there is some variability in these parameters, they are more stable than DO and can be measured with standard handheld meters that require less calibration than DO readings. The drawback to making these field measurements required would be requiring states to have meters and probes that meet some sort of minimum standards, which would add an additional equipment and logistic cost to states that don't already have meters/probes.
- There should be a place on the form for the crew to record the make and model of the meter they use for these readings in order for EPA to know the general accuracy. This was done in other national surveys.
- Whether or not these suggestions are accepted, the manual and forms should be reformatted to make sure it is very clear what readings are optional and water readings must be taken. Currently, the optional measures are included in a box with measures that are not optional (max depth of surface water). This needs to be much clearer.

Chapter 9. Algae

General comments on the chapter

- The flow of this chapter is unclear. The text and field form need to be reformatted to make it very clear how many samples are collected and what they contain.

- Within the text, samples are referred to as toxin samples, taxonomic samples, and composite samples, but the terminology is not always consistent. For instance, Table 9-2 is called “Collection of algae toxin epiphyte sample”, but epiphytic samples are collected for both the taxonomic sample and the toxin sample. Each type of sample needs to have one specific name that is used throughout the manual. If the composite sample refers to compositing subsamples of benthic and epiphytic habitats separately before combining them into the taxonomic sample, then that needs to be much clearer. In the following comments, the word composite is used with the taxonomic ID sample.
- In addition, the samples should always be referred to in the same order, composite taxonomic ID sample, algal toxin samples, chlorophyll-a sample. Switching the order and changing the name of the samples can both cause confusion.
- There should be a section at the beginning of this chapter that talks about the importance of following QA procedures. Some reviewers suggested this should be in a box or other format to really stand out. This should also be included in the water quality chapter.
- TRP members with experience in algal sampling were concerned about the specific preservatives advised. There was some discussion over the pros and cons of alternative, but no specific changes were decided upon. If the authors want to follow up on this discussion, experts should be consulted.

General comments on the form/labels

- The two separate boxes for taxonomic ID samples should be combined into one with a Y/N bubble for whether the samples were collected in wet habitats or dry habitats.
- In several boxes on the form, there is a bubble to fill if the habitat is present and also a bubble to fill if the sample was collected. The two questions are repetitive. If the habitat is present, a sample should be collected. And for every Y/N question, there should be two bubbles to answer Y or N.
- The form should have flags like the rest of the forms instead of spaces for comments.
- There should be a place on the sample labels to note whether or not the preservative was added and which kind.

Section 9.1 Protocol Summary

- Paragraph 4 within this section is particularly confusing and skips between samples. The last sentence of this paragraph mentions a water sample of **suspended phytoplankton** for toxin sampling. This sample is never mentioned again in the manual and is not on the form. This sentence should be removed unless this protocol is intended to be included and was left out.
- Somewhere in the very beginning, the chapter should include a bulleted list of the samples collected:
 - Composite Taxonomic ID Sample (always 1): Combined sample of *both* benthic and epiphytic (vegetation) habitats, if both habitats exist within the AA. If no appropriate vegetation exists, the taxonomic ID sample will be from benthic habitats only.
 - Algal Toxin Samples (1 or 2): One sample *each* from benthic habitats and epiphytic (vegetation) habitats, if both habitats exist. If no appropriate vegetation exists within the

- AA, only one sample from benthic habitats will be taken. Algal toxin samples will be taken from the material collected for the composite taxonomic ID sample, before material from the two habitats is combined.
- Chlorophyll-a (biomass) sample (0 or 1): One sample from the water column, only if surface water is present.
- Reiterate that at most, four samples will be taken if both appropriate vegetation *and* surface water occur within the AA. At a minimum, two samples will be taken if the AA lacks appropriate vegetation and surface water.
- We suggest adding a decision tree, flow chart, or key to the protocol summary that guides field team through the sampling. The pertinent questions are whether surface water is present and whether appropriate vegetation is present. Language like the following would improve the clarity (possibly restructured into a flow chart). All tables have been renamed for parallel naming structure:

Protocols for collecting samples

-I
f the AA lacks surface water > 15 cm, follow **Table 9-1 Protocols for sampling dry benthic habitats** and **Table 9-2 Protocols for sampling dry epiphytic (vegetation) habitats**. No chlorophyll-a sample will be taken.
-I
f the AA contains surface water > 15 cm, follow **Table 9-4 Protocols for sampling wet benthic habitats** and **Table 9-5 Protocols for sampling wet epiphytic (vegetation) habitats**. Also follow **Table 9-7 Protocols for collecting the chlorophyll-a sample**.
-F
or all AAs, follow **Table 9-3 Protocols for preparing the composite taxonomic ID sample**.

Distribution of samples between benthic and epiphytic (vegetation) habitats

-I
f the AA contains appropriate vegetation for epiphytic algae, sample five (5) benthic habitats and five (5) epiphytic (vegetation) habitats for the composite taxonomic ID sample and the algal toxin samples.
-I
f appropriate vegetation for epiphytic algae is lacking, sample ten (10) benthic habitats for the composite taxonomic ID sample and the algal toxin sample. In this case, only the benthic algal toxin sample will be prepared.

Section 9.2 Sampling Procedure

- If the flow chart or decision tree is presented in the opening section, this section should contain the six different protocols necessary.
 -P
rotocols for sampling dry benthic habitats

-*P*
rotocols for sampling dry epiphytic (vegetation) habitats
 -*P*
rotocols for sampling wet benthic habitats
 -*P*
rotocols for sampling wet epiphytic (vegetation) habitats
 -*P*
rotocols for preparing the composite taxonomic ID sample (There are currently two sections that describe this process [Table 9-3 and Table 9-6]. It is not clear why this is written twice, as it seems to be exactly the same process. However, the language is somewhat different and there are different figures imbedded within the two tables. This needs to be written once and should contain all information regarding preparation of the combined sample.)
 -*P*
rotocols for collecting the chlorophyll-a sample
- Wherever the steps in a protocol are exactly the same between dry and wet habitats, the wording should be exactly the same so crew can identify which steps are identical between the protocols and which are different.
 - **Section 9.2.1.1: Dry surface sediment sample.** It is unclear what the field crew would do if there are no obvious areas of past inundation. Would there be a case where no benthic samples would be taken? As written, it sounds like the crew would always take benthic samples. But the guidance specifically says to do so in areas that have been inundated for a period of time in the wet season. What about wetlands that are saturated and not inundated?
 - There is no specific guidance about how spaced out the samples should be. Are they taken from 1 m²? Or should they be distributed across the entire AA?
 - Why record the volume of the sediment sample if there is guidance to always fill the bottle to 450 ml? If this is the guidance, it should be followed. If this volume is important, why record it on the algal toxin part of the form, when it applies to both the toxin sample and the taxonomic sample?
 - **Section 9.2.1.2: Vegetation (epiphyte sample).** Why do you fill the vegetation sample to only 350 ml and the benthic sample to 450 ml? Why weight more heavily towards the benthic sample? If there is a well understood reason for this, it should be mentioned. Crews who understand the reason behind protocols will do a better job carrying them out.
 - **Section 9.2.1.3: Taxon ID sample.** This table should not be titled *Collection of algae composite sample* because the samples have already been collected and this protocol is about sample preparation.

- As noted above, the information in this section is repeated with slightly different words and a different figure in Table 9-6. If this information is the same, it should only be written once and should contain all information needed, included both figures. If there is something different about these tables, the differences should be very clearly spelled out.
- **Section 9.2.2.1: Benthic sediment sample and toxin sample.** In this table, it is specifically states that you take the algal toxin sample after collecting only 5 benthic habitats. If there is no appropriate vegetation, you take 5 additional benthic samples for the taxonomic ID sample, but only after the algal sample is removed. In the protocol for dry sediment sampling, this was not specified. Should it be added to the dry protocol?
- **Section 9.2.3: Biomass chlorophyll-a.** Members of the TRP with previous experience sampling algae strongly advise that field crews preserve the chlorophyll-a sample as water kept in a cool, dark place while in the field and filtered back at the truck.

Items Not Reviewed

There were several elements in the FOM/Level 3 sampling that were not discussed and will require some attention prior to 2011:

- **Decontamination:** Attainable goals need to be defined for field decontamination. It was suggested that the goal is zero possible transmission, which is a fine ideal but very difficult to execute in the field. A more appropriate goal is to minimize transmission where certain sequencing of site visits based on likelihood of invasive presence and then a protocol of physical cleaning occurs. Some decon items in the FOM that cause concern:
 - No guidance on site sequencing (i.e., go to probable intact sites first, and then go probable sites with insives)
 - Hand pump will not deliver enough water to clean. Recommend using a power washer that plugs into car with a larger tank
 - How effective is 1% bleach? How hard is it to carry a supply over long term field expeditions? What kind of additional wear and tear does bleach do to equipment?
 - The FOM states that equipment should be dried before going to next site. Once on a field trip the equipment will never be dry, thus to meet this goal each crew must have a complete 2nd set of equipment.

As an example, how easy was it to clear the clay from the soils demo off of boots?

- **Field Photos:** A number elements could be systematically photographed that need to be discussed and specified. Infrastructure to manage these photos must then be created linked to the primary identifier for that element. Elements include:
 - **AA Photos Along Cardinal Directions**-(already specified in FOM)
 - **Veg plot overview**-confirmation of finer community type actual sampled in plot, useful to investigate questionable data on field forms
 - **Soil slabs/pits**-can aid NRCS interpretation, useful to investigate questionable data on field forms

- **Buffer Plot overview** -useful to investigate questionable data on field forms
 - **T&E Plant Voucher Photos**-used in lieu of collection for T&E species
 - **Miscellaneous phenomena**-Odd occurrences that could be affecting condition of site
- **Sample Processing/Tracking/Shipping:** Has anyone actually attempted to fully process a full suite of site samples, fill out the tracking forms, and shipped them to the lab? How well did it go?